الجمهورية الجزائرية الديمقراطية الشعبية
People's Democratic and Republic of Algeria

Ministry of Higher Education and Scientific Research

National School of Cyber Security

NSCS
المدرسة الوطنية العليا في الأمن السيبراني
NATIONAL SCHOOL OF CYBERSECURITY

وزارة التعليم العالي والبحث العلمي

المدرسة الوطنية العليا في الأمن السيبراني

Algorithms and Static data structures

Series of exercises number 03

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Exercise 1: Basic Calculator

- **Problem**: Write an algorithm that acts as a basic calculator. The algorithm should prompt the user to enter two numbers and an operator (+, -, *, /). Use a **switch** statement to perform the corresponding operation and print the result. If an invalid operator is entered, print an error message.
- **Example**:
    - Input: Enter first number: 8
    - Input: Enter second number: 4
    - Input: Enter operator (+, -, *, /): *
    - Output: Result: 32

Exercise 2: Numeric Palindrome:

- **Problem**: Create an algorithm that checks whether an input integer is a palindrome, meaning it reads the same forward and backward.
- **Example**: The number 121 is a palindrome, but 123 is not.

Exercise 3: Equation with Constraints:

- **Problem**: Write an algorithm to find all sets of integers **a**, **b**, and **c** such that a+b+c= 10 where a,b,c>0
- **Example**: **Some** possible solutions are (1, 1, 8), (2, 3, 5), etc.

Exercise 4: Magic Number Check

- **Problem**: An integer is considered a magic number if the sum of its digits, repeatedly calculated until a single digit is obtained, equals 1.
- **Example**: Input 19 should output "true" (1 + 9 = 10; 1 + 0 = 1).

Exercise 5: Number Pattern Printing:

- **Problem**: Write an algorithm to print a number pattern based on a given integer N.
- **Example**:

```
Input: 5
Output:
1
1 2
1 2 3
1 2 3 4
1 2 3 4 5
```

Exercise 6: Count the Number of Vowels and Consonants:

- **Problem**: Write an algorithm that counts the number of vowels and consonants in a given string.
- **Example**: Input "algorithm" should output 3 vowels and 5 consonants.

Exercise 7: Alternating Maximum

- **Problem**: Given two four-digit numbers A and B, construct a new number C such that C is formed by taking the maximum digit from A and B alternately.
- **Example**, if A = 1234 and B = 5678, then: C = max(1,5) max(2,6) max(3,7) max(4,8) = 5 6 7 8.

Exercise 8: Shifted Digits

- **Problem**: From two four-digit numbers A and B, create a new number C by shifting the digits of A one position to the left and then interleaving with the digits of B.
- E**xample**, if A = 1234 and B = 5678, then shifting A gives 2341, and C = 2 5 3 6 4 7 1 8.

Exercise 9: Smallest/largest divisor

- **Problem** Let N be a given integer. Write the solution that finds the smallest divisor of N other than 1 and the largest divisor of N other than itself.
- **Example** 1: N=7 Result: N HAS NO DIVISOR
- **Example** 2: N=4 Result: N HAS ONLY ONE DIVISOR: 2
- **Example** 3: N=8 Result: SMALLEST DIVISOR: 2 LARGEST DIVISOR: 4